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Title: Neutron Radiography at LANSCE: Interrogating and Characterizing Materials for Next Generation Nuclear Reactor Designs

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Neutron Radiography at LANSCE: Interrogating and Characterizing Materials for Next Generation Nuclear Reactor Designs

Neutron radiography is an ideal probe for integrating and characterizing potential nuclear fuel and moderator materials in next generation nuclear reactor designs. Due to the nature of interaction with the nucleus, neutrons have complex attenuation functions that result in contrast mechanisms and material penetrabilities that are well suited not only for investigating materials that contain high-Z isotopes (such as actinides in nuclear fuels), but also for characterizing various hydride materials which are being considered in future moderator designs. Additionally, with a high intensity, short-pulsed neutron source (pulse duration significantly shorter than moderation time), Energy-Resolved Neutron Imaging (ERNI) can be utilized to map out specific isotopes based on neutron resonance absorptions with in a given sample.

To date, the Los Alamos Neutron Science Center (LANSCE) has developed general neutron radiography and ERNI capabilities on Flight Path 5 (FP05) specifically for characterizing nuclear fuels and moderator materials. Here, we will present some of our efforts in developing these capabilities along with initial results from notable measurements in our most recent run cycle. These neutron radiography measurements range from thermophysical property characterization of uranium based molten salts, to H-concentration mapping in yttriumhydride and zirconiumhydride materials, to isotope mapping in fresh and irradiated fuel samples for post-irradiation examination (PIE).